

We Claim:

1. A magnesium-based hydrogen storage material including
magnesium or a magnesium-based hydrogen storage alloy; and
a hydrogen desorption catalyst,

wherein said hydrogen desorption catalyst is insoluble in said magnesium-based hydrogen storage alloy and is in the form of:

- 1) discrete dispersed regions of catalytic material in the bulk of said magnesium or magnesium-based hydrogen storage alloy;
- 2) discrete dispersed regions on the surface of particles of said magnesium or magnesium-based hydrogen storage alloy;
- 3) a continuous or semi-continuous layer of catalytic material on the surface of said magnesium or magnesium-based hydrogen storage alloy which is in bulk or particulate form; or
- 4) combinations thereof.

2. The magnesium-based hydrogen storage material of claim 1, wherein said magnesium-based hydrogen storage alloy includes at least 80 atomic percent magnesium.

3. The magnesium-based hydrogen storage material of claim 2, wherein said magnesium-based hydrogen storage alloy further includes aluminum.

4. The magnesium-based hydrogen storage material of claim 1, where in said hydrogen desorption catalyst includes iron.

5. The magnesium-based hydrogen storage material of claim 4, wherein said hydrogen desorption catalyst further includes one or more elements selected from the group consisting of B, Cu, Pd, V, Ni, C, Mn, Zr, Rb, Nb, Ti, U and Sc.

6. The magnesium-based hydrogen storage material of claim 1, wherein said hydrogen desorption catalyst comprises discrete dispersed regions of catalytic material in the bulk of said magnesium or magnesium-based hydrogen storage alloy.

7. The magnesium-based hydrogen storage material of claim 6, wherein said magnesium-based hydrogen storage material is formed by the steps of:

a) mixing powders of said magnesium or magnesium-based hydrogen storage alloy and powders of said hydrogen desorption catalyst;

b) pressing the mixed powders into a compact; and

c) sintering/annealing said compact at a temperature between 450 °C and 600 °C.

8. The magnesium-based hydrogen storage material of claim 7, wherein said sintering/annealing is performed for at least 10 hours.

9. The magnesium-based hydrogen storage material of claim 6, wherein said magnesium-based hydrogen storage material is formed by the steps of:

a) forming a melt of powders of said magnesium or magnesium-based hydrogen storage alloy and powders of said hydrogen desorption catalyst in a protective atmosphere;

b) stirring said melt to insure suspension of the insoluble powders of said hydrogen desorption catalyst within the molten magnesium or magnesium-based hydrogen storage alloy;

c) rapidly quenching the stirred melt such that the suspended insoluble powders of said hydrogen desorption catalyst are well distributed in the solidified magnesium or magnesium-based hydrogen storage alloy.

10. The magnesium-based hydrogen storage material of claim 1, wherein said hydrogen desorption catalyst comprises discrete dispersed regions on the surface of particles of said magnesium or magnesium-based hydrogen storage alloy.

11. The magnesium-based hydrogen storage material of claim 10, wherein said magnesium-based hydrogen storage material is formed by the steps of:

a) mixing powders of said magnesium or magnesium-based hydrogen storage alloy and powders of said hydrogen desorption catalyst; and

b) mechanically alloying the mixture in an attritor such that powder particles of said hydrogen desorption catalyst are embedded in at least the surface of powder particles of said magnesium or magnesium-based hydrogen storage alloy.

12. The magnesium-based hydrogen storage material of claim 10, wherein heptane and carbon powder are used as grinding aids during mechanical alloying of said mixture.

13. The magnesium-based hydrogen storage material of claim 1, wherein said hydrogen desorption catalyst comprises a continuous or semi-continuous layer of catalytic material on the

surface of said magnesium or magnesium-based hydrogen storage alloy which is in bulk or particulate form.

14. The magnesium-based hydrogen storage material of claim 13, wherein said magnesium-based hydrogen storage material is formed by the steps of:

- a) providing bulk or particulate magnesium or magnesium-based hydrogen storage alloy; and
- b) depositing a continuous or semi-continuous layer of catalytic material onto the surface of said bulk or particulate magnesium or magnesium-based hydrogen storage alloy by vapor deposition, electrolytic coating or electroless coating.

15. The magnesium-based hydrogen storage material of claim 14, wherein said step of depositing a continuous or semi-continuous layer of catalytic material onto the surface of said bulk or particulate magnesium or magnesium-based hydrogen storage alloy comprises evaporation of said catalytic material.

16. The magnesium-based hydrogen storage material of claim 13, wherein said a continuous or semi-continuous layer of catalytic material is about 100 angstroms thick.

17. The magnesium-based hydrogen storage material of claim 14, wherein said step of providing bulk or particulate magnesium or magnesium-based hydrogen storage alloy includes providing bulk or particulate magnesium or magnesium-based hydrogen storage alloy having hydrogen desorption catalyst disposed in discrete dispersed regions within the bulk or particulate magnesium or magnesium-based hydrogen storage alloy.

18. The magnesium-based hydrogen storage material of claim 17, wherein said step of providing bulk or particulate magnesium or magnesium-based hydrogen storage alloy includes:

- a) mixing powders of said magnesium or magnesium-based hydrogen storage alloy and powders of said hydrogen desorption catalyst;
- b) pressing the mixed powders into a compact; and
- c) sintering/annealing said compact at a temperature between 450 °C and 600 °C.

19. The magnesium-based hydrogen storage material of claim 18, wherein said sintering/annealing is performed for at least 10 hours.

20. The magnesium-based hydrogen storage material of claim 17, wherein said step of providing bulk or particulate magnesium or magnesium-based hydrogen storage alloy includes:

- a) forming a melt of powders of said magnesium or magnesium-based hydrogen storage alloy and powders of said hydrogen desorption catalyst in a protective atmosphere;
- b) stirring said melt to insure suspension of the insoluble powders of said hydrogen desorption catalyst within the molten magnesium or magnesium-based hydrogen storage alloy;
- c) rapidly quenching the melt such that the suspended insoluble powders of said hydrogen desorption catalyst are well distributed in the solidified magnesium or magnesium-based hydrogen storage alloy.

21. The magnesium-based hydrogen storage material of claim 14, wherein said step of providing bulk or particulate magnesium or magnesium-based hydrogen storage alloy includes:

- a) forming a melt of said magnesium or magnesium-based hydrogen storage alloy; and

b) rapidly quenching said magnesium or magnesium-based hydrogen storage alloy by a bulk quick quenching method.

22. The magnesium-based hydrogen storage material of claim 21, wherein said bulk quick quenching method includes melt spinning, centrifugal atomization, gas atomization, or water atomization.